MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

ETM3056 – MULTIMEDIA AND COMMUNICATION NETWORKS

(TE)

24 OCTOBER 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 5 pages with 4 Questions only.

2. Attempt **ALL** questions. Each question carries an equal total mark and the mark distribution for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) Text is coded as one important element in a multimedia system. Briefly explain why text must be coded in a multimedia system.

[4 Marks]

(b) An image is generated using a computer.
   (i) Suggests the type of image which is generated by the computer.
   (ii) If the image is printed and found out to have a poorer sharpness as compared to the image seen in the computer screen, what is likely the main reason for this?
   (iii) Write the formula for calculating the size of an image in bits.

[2+2+2 Marks]

(c) Name two types of multimedia which are synthesized and continuous?

[4 Marks]

(d) Two important features of continuous media are delay sensitive and loss tolerant. Briefly describe what you understand by these two features. Give one important property of continuous media.

[6 Marks]

(e) Briefly explain about two sound properties. Is a MIDI file considered as a waveform representation of parametric representation of a sound?

[5 Marks]

Continued...

Question 2

(a) Briefly explain two differences between lossless and lossy data compression.

[4 Marks]

(b) A video clip requires 4CIF video resolution (704 x 576) with 24 bits per pixel. Assuming that the frame rate is 25 fps and the duration of the clip is 45 mins, determine how many video clips of the same specifications can be stored in a hard disk with capacity of 1 TB.

[4 Marks]

(c) Propose two techniques to increase the number of video clips, as specified in Question 1 (b), in the 1 TB hard disk and justify your answer.

[4 Marks]

(d) Use Huffman coding to encode the string "event". Find average number of bits to encode each character. Compare with the entropy of the string. Find the compression ratio by comparing Huffman coding and fixed length coding. Assume the following probability of occurrence for the symbols. P(e) = 0.6, P(v) = 0.1, P(n) = 0.2 and P(t) = 0.1

[5 Marks]

(e) Three symbols [X, Y, Z] are used with the following estimated probability

$$P(X) = 0.3, P(Y) = 0.5, P(Z) = 0.2$$

Find the code and number of bits to encode the message XYZ by using arithmetic coding, which is written as follows:

```
BEGIN
   Low = 0.0; high = 1.0; range = 1.0;

       while (symbol != terminator)
    {
      get  (symbol);
      high = low + range * Range_high(symbol);
      low = low + range * Range_low(symbol);
      range = high - low;
    }
   Output a code so that low <= code < high;
END
```

(assume Range_low(X) = 0, Range_high(X) = 0.3, Range_low(Y) = 0.3, Range_high(Y) = 0.8, Range_low(Z) = 0.8, Range_high(Z) = 1)

[8 Marks]

Continued...

Question 3

(a) A Public Switched Telephone Network (PSTN) system is designed to provide both analog and digital services to the users.

(i) Name and briefly describe two types of analog services supported by telephone networks.

(ii) Name and briefly describe two types of digital services supported by telephone networks.

(iii) If a user wishes to have a data service at a rate of 60 kbps, analyze the type of services that can be offered to this user? Justify your answer.

[4+4+3 Marks]

(b) SONET/SDH is a high-speed transport network for transporting data over the telecommunication networks.

(i) Briefly explain the general concepts and principles of SONET.

[4 Marks]

(ii) How is the STS signal changed to carry or transport other types of signals such at ATM signals? If an STS-3c signal has 90 octets of data reserved in the overhead, how many ATM cells which can be transported by an STS-3c signal (Hint: An ATM cell size is 53 bytes).

[8 Marks]

(c) What is the function of H1 and H2 pointers in an STS signal?

[2 Marks]

Continued...

Question 4

(a) Long-Term Evolution (LTE) – Advanced has been actively developed to offer higher data rates in both downlinks and uplinks in cellular communications.

(i) Coordinated Multi-point (CoMP) is one of the main features in LTE-Advanced technology. In which release (standard) of Third Generation Partnership Project (3GPP) that this feature is specified?

(ii) Briefly explain three forms of basic cooperative transmission techniques which are employed in communication networks.

(iii) Explain three types of user pairing schemes which can be implemented in LTE-Advanced systems.

(iv) A user pairing scheme is applied in an LTE-Advanced system with four users to select two pairs of users. The measured values of the channel quality and the correlation between every pair of users in the system are tabulated in Table Q4 (a). Determine the two pairs of users based on the maximal orthogonal pairing scheme.

[2+6+6+4 Marks]

Users Pairs	Channel Quality (bits/s/Hz)	Correlation
User 1 and User 2	20.0	0.512
User 1 and User 3	19.0	0.376
User 1 and User 4	19.3	0.625
User 2 and User 3	18.9	0.794
User 2 and User 4	21.7	0.418
User 3 and User 4	19.6	0.234

Table Q4 (a)

(b) ATM network is a type of packet-switching networks which also apply some of the features in circuit switching.

(i) State three advantages of ATM.

[3 Marks]

(ii) Briefly explain the advantage(s) of having fixed-sized packet?

[4 Marks]

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